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Iceland's Agriculture

by KAREN J. FRIEDMANN*.

When in the summer of 1944 Iceland severed its union with Denmark, one of the oldest democracies in the world emerged as its newest republic. In the economic life of the nation this change in status should not be expected directly to produce great changes. Of more immediate consequence is the close relationship with the United States, brought about by wartime conditions, a development which has stimulated interest in the country and its people. While the efficiency and importance of the Icelandic fishing industry is generally known, some of the salient features of Icelandic agriculture, the most basic and predominant occupation of the people, are well worth consideration.

In spite of its forbidding name, its location which touches upon the Arctic Circle, its vast barren and mountainous interior, its glaciers, hot springs, and volcanoes, Iceland was in earlier days predominantly an agricultural country, and agriculture still provides a livelihood for a larger share of the population than any other occupation. In 1930, 39,000 of the country's 109,000 inhabitants derived their living from agriculture and 23,400 from fishing, which in numbers employed is second among gainful occupations. The only sizable town in Iceland—and the only one providing a market for agricultural products—is the capital, Reykjavik, with 37,000 inhabitants.

The climate of this big island would be severely arctic were it not modified by the Gulf Stream. Summers are cool and winters mild, but the weather is highly variable. Not only do sudden changes from day to day occur, but a particular season of the year may vary quite considerably in different years. This results in a large measure from the varying ice conditions in the ocean surrounding the country. In some years the polar ice is barely seen, but in other years, in late winter and spring, the ice comes close to the northern and eastern coast, sometimes blocking harbors and piling up along the shores, bringing sustained low temperatures. Unprotected places are wind-swept, and strong gales are frequent in wintertime. Days of frost vary in number from 109 to 192, and in some parts of the country fogs often prevail. (For average temperatures and precipitation in various parts of the country, see table 1.)

The most conspicuous features of Iceland are its numerous volcanoes, lava flows, extensive snow fields, and broad high tablelands deeply dissected by streams and glaciers. The tablelands are bounded by cliffs or terraces in many places near the sea, providing excellent nesting places for thousands of sea birds.

Widely distributed deposits of glacial gravel and boulders bear witness to the action by ice, extensive during the glacial period and continuing in reduced extent to the present time, which has cut deep grooves in the basalt foundations. Deposits of erupted basalt and volcanic ash were intermingled with glacial gravel at various times and in many places in the country, whereas locally remains of ancient forests of the middle or late Cenozoic Age are buried in the earliest rocks of the island.

Volcanic activity has played a prominent part in shaping the surface of the country and has influenced its human history as well, on the one hand, by providing an excellent source material for soil and, on the other, by repeatedly bringing disaster to the population.

Rocks and lava, slowly broken down by atmospheric erosion or the action of glaciers, as well as volcanic ashes, are carried far and wide by the wind and the numerous rivers of the island. When the wind-borne ash and other volcanic materials settle in sheltered places, they form a source of rich soil. In the lowlands are also vast boggy areas that produce a considerable part of the Icelandic hay crop. A number of tests have shown that the natural fertility of the Icelandic soil is good. But of the country's 39,400 square miles, 5,000 are mountainous, estimates place the lava fields at 4,600, and gravel and sand cover 9,600 square miles.

Estimates indicate that one-half of the country carries vegetation—mainly grass. Furthermore, about 5,000,000 acres of this grass-covered land are estimated to be potentially tillable; but actually less than 100,000 acres of land, or less than 0.5 percent of the total area, are being cultivated. In addition there are, however, large areas in natural meadows and vast mountain pastures that are of the greatest importance in Iceland for livestock raising.

Forests, mostly birch, which in early historic times covered larger areas of the country, are now found only here and there in sheltered places, and the trees rarely reach a height of 10 feet. They should perhaps more properly be termed brushwoods. The largest wooded area is found in the eastern part of the country and covers a mere 1,500 acres, but de-

*Office of Foreign Agricultural Relations.

TABLE 1.—*Average temperatures (Fahrenheit) and precipitation, by months, 1876–1925*

Period	Reykjavik (64°09′ N.–21°56′ W.)		Stykkishólmur (65°05′ N.–22°46′ W.)		Hraun í Fljótum (66°06′N–19°04′ W.)		Akureyri (65°41′ N.–18°05′ W.)		Teigarhorn (64°41′ N.–14°22′ W.)		Vestmannaeyjar (63°24′ N.–20°17′W.)	
	Degrees	Inches	Degrees	Inches	Degrees	Inches	Degrees	Inches	Degrees	Inches	Degrees	Inches
January	29.8	3.94	28.6	3.03		1.38	26.2	1.34	30.0	5.12	33.3	6.10
February	29.8	3.07	27.7	2.56		1.26	25.9	1.14	30.0	3.94	33.1	4.80
March	31.1	2.76	28.4	1.93		1.06	26.6	1.06	29.8	3.11	33.4	4.45
April	36.3	2.40	33.1	1.50		1.26	33.1	1.02	34.5	3.19	37.6	3.74
May	42.8	1.93	39.9	1.30		.91	40.1	.94	39.6	2.91	42.3	3.19
June	48.6	1.89	46.8	1.46		.98	48.6	.91	45.3	2.60	47.1	3.23
July	51.6	1.93	50.0	1.42		1.46	50.7	.87	48.0	2.64	50.2	2.95
August	50.5	2.05	48.7	1.57		2.68	48.4	.98	47.3	3.23	49.1	2.87
September	45.5	3.50	45.1	2.68		3.11	44.0	1.14	44.2	4.84	45.3	5.47
October	39.2	3.50	38.8	2.99		3.07	36.3	1.10	38.5	5.00	40.3	5.59
November	33.8	3.70	33.3	2.80		2.80	30.0	1.18	33.6	4.41	35.8	5.24
December	30.0	3.58	29.5	2.44		1.54	26.8	1.54	30.9	5.55	33.1	5.47
January–December	39.0	34.25	37.6	25.68		21.50	36.5	13.22	37.8	46.54	40.1	53.10

Official statistics.

sirability of a return of the forests is recognized, and reforestation measures are being carried out with some success.

These few data regarding the physical background of agriculture in Iceland already give an indication of the type of agriculture that prevails; namely, livestock raising based on pasturing supplemented with hay for winter feed, derived partly from cultivated home fields and partly from natural meadows—an extensive, pastoral type of agriculture.

Size of Farms

In only a few localities is the exact size of Icelandic farms known, but any average farm is understood to comprise a total of from 1,200 to 1,500 acres of land, including unproductive areas. Of this, only 1 percent—12 or 15 acres—is under actual cultivation, producing mainly grass for hay, whereas some 75 acres may be meadowland. A considerable part of the land in farms is in mountain pastures, and the rest is barren wasteland. Farms, however, vary greatly in size and may be from about 50 acres to several thousand acres. They are obviously not found in villages but are scattered over the countryside and often are quite isolated.

There is a dearth of domestic building materials in Iceland, and until about 1850 most farmhouses were constructed from stone and peat with wooden "linings." They were small and consisted of a series of connected one-room buildings. Modern farm buildings are, however, often made of concrete and comprise many rooms. According to a survey in 1932, 16 percent of all farmhouses were concrete structures, 27.5 percent wooden, 38.5 percent were still of the old peat type, and 18 percent were made of various other materials.[1]

[1] SIGURDSSON, SIGURDUR. LANDBURG OG LANDBOFORHOLD I ISLAND. 242 pp., illus. Copenhagen. 1940.

Roughly four-fifths of the Icelandic farms are privately owned, but only one-half of the farmers own the farms they operate. The trend is toward ownership, however, for around the middle of the last century only 17 percent of the farms were owner-operated and in 1910, 37 percent. In 1932, 2,346 of Iceland's 5,736 farms were operated by tenants. This is a much higher degree of tenancy than in the Scandinavian countries.

Methods of cultivation are simple but subject to continuous modernization as conditions warrant. For hundreds of years the chief improvement of the home fields consisted in manuring. The first plows were imported from Denmark around the middle of the eighteenth century. Since the fields of Iceland are subject to peculiar hillock formations, the first improvements, besides manuring, consisted in the arduous task of leveling the hillocky home fields. Only then could further improvements be introduced through plowing and the use of field machinery. In addition to leveling, fencing and draining have been among the major improvements. Furthermore, the productivity of the natural meadows has been greatly increased in certain localities through irrigation. Before this war there were eight such irrigation projects in the country.

Machinery and Fertilizers

Around the turn of the century several types of machinery were introduced to Icelandic farmers. The first mowers came in 1894, the first hay rakes in 1895, and tedders have been in use since 1908. Before the war mowers were found on one out of every three farms. Tractors were introduced in 1918 and have greatly eased the job of leveling.

The outstanding development in Icelandic agriculture during the last couple of years has been an accelerated rate of mechanization, not so much intro-

duction of new types of machinery as an increase in the importation and use of machinery already known. Construction work in connection with the stationing of troops in Iceland and increased fishing activities caused a shortage of agricultural labor, and the farmers' reply to this situation was mechanization. A Government-supported program for further mechanization of agriculture in the post-war years is also contemplated.

For centuries the only fertilizing that took place consisted in the application of manure, mainly sheep manure, stored and spread in such a way that much of its plant-food content was lost. Nowadays, such farm fertilizer is handled better, two-thirds of it being stored in pits. Around the middle of the eigtheenth century, Icelanders began to use seaweed and fish waste as fertilizers, and in this century chemical fertilizers have come into use. In the late 1930's, roughly 4,000 tons of fertilizers were imported annually, of which calcium nitrate constituted the larger share. Irrigation may properly be mentioned in this connection also because of the plant-food content of broken-down rock material deposited by the creeks and rivers.

Land Use, Crops, and Crop Utilization

There has been a steady increase in the area of cultivated home fields before and during this war. The principal cultivated crop is hay, but potatoes and other roots are also of importance. Practically no grain is grown. Home fields and meadows provide about equal amounts of hay (table 2), but the cultivated hay is of better quality and is mainly used as winter feed for cattle, whereas meadow hay is fed to sheep. Until the end of the nineteenth century, pasturage and hay were practically the only cattle feeds available, and a total of from 6,000 to 7,000 pounds of hay was considered the proper amount of winter feed for a cow. Now some silage, grain, bran, and fish meal are also used, but hay remains the important winter feed. In summertime the cattle graze in the fields and meadows near the farm, and the sheep are left free to crop the mountain pastures.

Potato and other root crops undergo great fluctuations. Potato production is usually not large enough to meet the country's requirements for human consumption. Before the war, from 1,300 to 1,400 short tons of potatoes were imported annually. Some vegetables, such as cabbages and carrots, are grown in the field but only in small amounts. There are, however, possibilities for expanded hothouse production of vegetables in Iceland, since the hot water of the geysers is now being utilized for heating the hothouses. The first such hothouse was constructed in 1923, and up to the outbreak of war the area covered by these structures totaled 2.5 acres. Tomatoes constitute the most important vegetable crop raised and came to 88,000 pounds in 1938. Finally, mention might be made of the gathering of wild plants, such as Iceland moss, which has been important in the past for supplementing the food supplies of the Icelandic people.

Livestock and Livestock Products

All Icelandic livestock breeds—cattle, as well as sheep and horses—originated in Norway and were brought in by the first settlers of Iceland a thousand years ago. Only slight changes in breeds took place through the centuries. Some cattle were imported from Denmark, Sweden, and the British Isles, but no real improvement of breeds was undertaken until recent years and then not through introduction of foreign breeds but by improving the old Norwegian cattle. The animals are not large, the average live weight of cows being around 650 pounds, but the milk yield is surprisingly high. In the late 1930's the average was estimated at 5,700 pounds annually per cow. This figure, however, may possibly represent the average yield of herds under observation rather than an average for all Icelandic cows.

Attempts were made in the eighteenth century to improve the original Norwegian sheep, through the introduction of English and Spanish breeds, with rather disastrous results, for diseases formerly unknown among Icelandic sheep were introduced and caused extensive losses. As in the case of cattle, the improvement in recent years has come through selective breeding within the original breeds. Sheep-breeding centers are now found in various parts of the country. The first was established in 1897, and in 1938 there were eight.

Practically no attempts have been made to add

TABLE 2.—*Cultivated acreage and crops in Iceland, 1937–41*

Item	1937	1938	1939	1940	1941
Acreage:	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Cultivated grassland	84,400	86,109	87,923	88,889	89,668
Roots, etc	1,712	1,823	2,162	5,312	2,471
Crops:	*Short tons*	*Short tons*	*Short tons*	*Short tons*	*Short tons*
Hay:					
From cultivated meadows	110,730	120,984	145,572	134,042	152,576
From natural meadows	115,269	109,848	123,239	127,312	123,485
Potatoes	6,963	7,130	13,185	8,429	13,763
Other roots	1,633	1,944	2,842	1,052	2,777

Compiled from official statistics.

new blood to the Norwegian breed of horses, which the settlers brought to Iceland, and which in the course of time has become exceedingly well adapted to Icelandic conditions. The present Icelandic horse is a small, hardy, sure-footed animal that not only furnishes draft power on farms but, until the introduction of automobiles and construction of roads in this century, was also the sole means of transportation in the country.

Numbers of livestock have shown great fluctuations in the course of time. Cattle, for instance, were much more numerous in the days of the sagas—estimated to have been as high as 135,000 or four times as many as now—when sheltering forests created more favorable conditions for vegetation. Cattle, horses, and hogs have increased in number during recent years, but sheep, goat, and poultry numbers have declined (table 3). While sheep predominate in all parts of the country, a somewhat greater concentration of cattle occurs in southwestern Iceland than elsewhere. (See fig. 1.)

TABLE 3.—*Numbers of livestock in Iceland, 1937–41*

Types	1937	1938	1939	1940	1941
	Number	*Number*	*Number*	*Number*	*Number*
Horses	47, 222	49, 018	52, 545	55, 876	57, 968
Cattle:					
Total	37, 886	36, 696	37, 412	39, 732	39, 778
Cows	27, 451	27, 004	27, 627	28, 597	28, 772
Sheep:					
Total	655, 356	591, 948	593, 785	627, 941	637, 067
Ewes	461, 011	436, 394	434, 132	436, 925	451, 437
Goats	1, 807	1, 740	1, 604	1, 628	1, 568
Hogs	323	632	363	458	593
Chickens	84, 675	86, 092	77, 365	72, 714	67, 586
Ducks and geese	3, 638	3, 572	2, 480	2, 270	1, 772

Compiled from official statistics.

Dairy products and mutton are the most important animal foodstuffs produced. Dairy products are almost entirely used for domestic consumption, but products of the sheep industry—mutton, wool, and sheepskins—are exported to a considerable extent. The annual production of milk comes to about 146 million pounds, of which close to 65 million pounds appear to be consumed as fresh milk. This would indicate an average per capita consumption of over

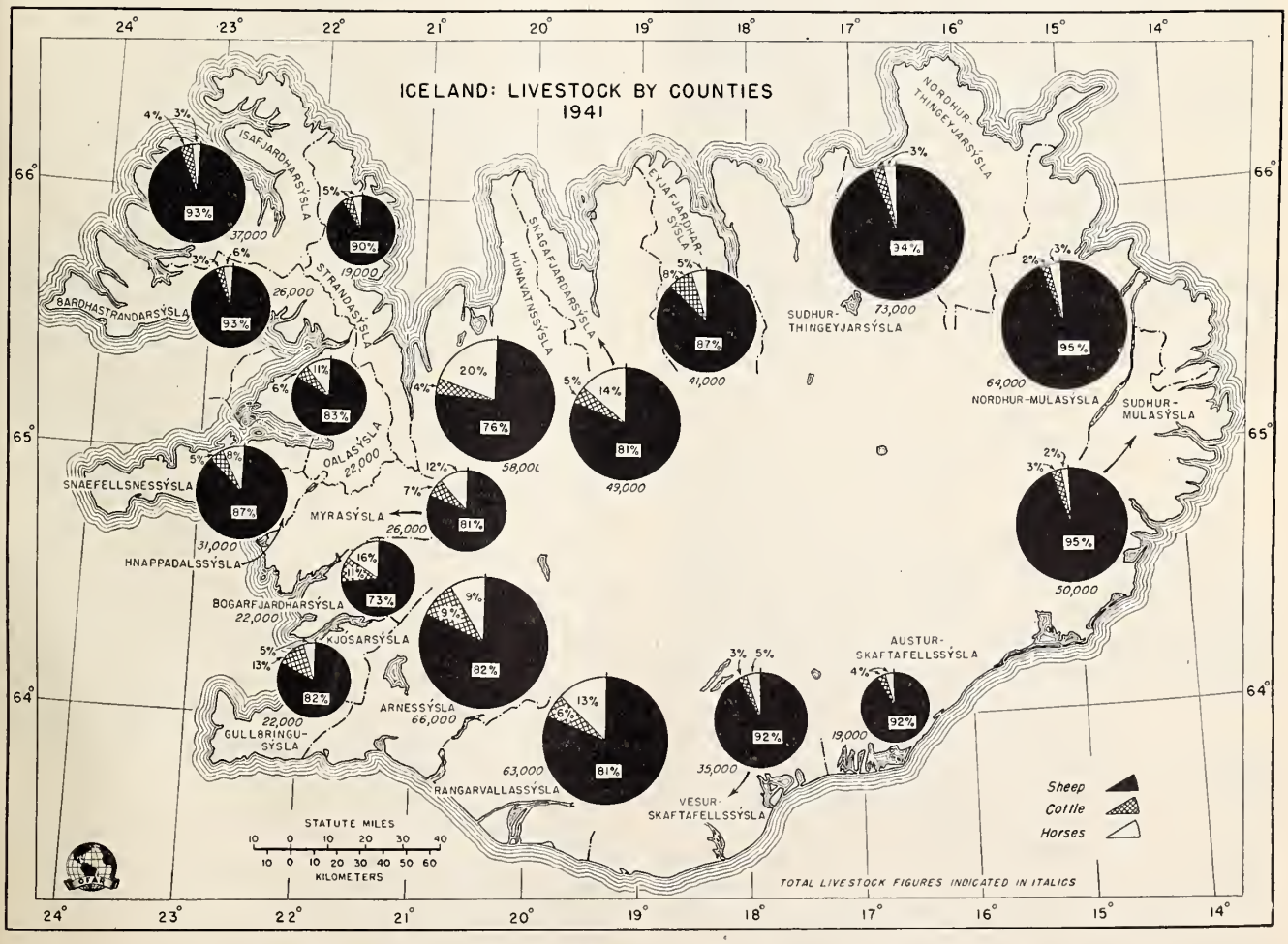

FIGURE 1.—Map of Iceland, showing distribution of livestock numbers by counties.

500 pounds, a very high level of milk consumption. Approximately 900 tons of butter and 300 tons of cheese, in addition to 3,300 tons of "skyr," a cheese-like skim-milk product, are also produced annually. Sheep raising for milk production has been more or less abandoned in this century; the emphasis is now on meat production. In earlier days, ewes were kept near the farm during the summer months and each gave about 100 pounds of milk during the season. The annual production of mutton totals almost 8,000 tons and, in addition, other meats amount to 2,200 tons. Hogs and goats are not important in Iceland, but poultry has some significance.

In addition to these agricultural products, Icelandic farmers also market certain other products of a similar nature. Thus, birdcatching, egg collecting, and the gathering of eiderdown have become sources of income. Fur-bearing animals are kept, and, since conditions in respect to climate and feed supplies are favorable, expansion is possible.

Flocks of reindeer were introduced to Iceland from northern Norway toward the end of the eighteenth century. They were, however, never domesticated, since the role they play in the economy of the Lapps in Norway was already taken by the horse and cow in Iceland. But some of them are still living in the mountainous northeastern parts of Iceland.[2]

Foreign Trade

During the war there has been some increase in Iceland's foreign trade owing to the presence of troops in the country and to a higher income level. Furthermore, there has been of necessity a shift in trade away from continental Europe and to the United States, Great Britain, and Canada. The continuance of this trade after the war is a matter of speculation. Pre-war trade figures give, perhaps, a better indication of Iceland's normal peacetime imports and exports of agricultural items than do current statistics. (See tables 4 and 5.)

There was a time when agricultural products constituted the bulk of Iceland's exports. They have dwindled in relative importance, however, although the need for imports, not only of agricultural products, but also of industrial commodities and raw materials, has increased, and fishing has undergone a tremendous development.

The flow of agricultural products to and from Iceland is obviously quite insignificant in world trade, but for the Icelandic farmer exports of wool, hides, mutton, and live horses are important. Furthermore, for efficient production of livestock fodder the importation of some fertilizers, feed, and machinery is essential. The almost complete absence of grain and sugar beets in Iceland also make imports of flour and sugar imperative, and imports of oils for margarine production are significant.

As a consequence, Iceland has for many years been high among the countries having a large per capita foreign trade. In 1929 the country actually had the largest per capita imports in the world. This fact bears witness not only to the limited range of commodities produced in Iceland and the resulting need for imports but, in a sense, also to a relatively high standard of living.

Although increased mechanization and modernization may expand the agricultural output of the island, Iceland must look to its large, modern, and growing fishing industry for an export surplus, in order to be able to import the products needed to maintain its recently improved standard of living.

TABLE 4.—*Imports of foodstuffs and agricultural equipment into Iceland, 1937–42*

Item	1937	1938	1939	1940	1941	1942
	Short tons	*Short tons*	*Short tons*	*Short tons*	*Short tons*	*Short tons*
Grain, unmilled	1,576	1,996	1,400	1,391	1,730	1,699
Flour and groats	15,507	14,976	14,078	11,334	13,127	22,846
Concentrates	1,507	1,949	1,216	1,020	594	2,363
Potatoes	561	1,456	1,360	287	2,361	
Potato flour	357	241	302	223	396	366
Fruits and vegetables	875	1,279	924	1,210	1,621	3,431
Sugar and sirup	6,183	5,567	6,402	5,094	6,145	5,859
Vegetable oils	1,140	1,468	1,133	1,464	1,612	1,260
Fertilizers	3,641	3,991	4,845	2,353	3,648	4,135
	Pieces	*Pieces*	*Pieces*	*Pieces*	*Pieces*	*Pieces*
Mowers	246	139	93		5	151
Hay rakes	135	195	107		4	61
Separators	(1)	280	400	21	435	727
Churns		57	85	85		
Tractors	2					

[1] Under "other agricultural machinery" are listed 249 pieces, probably mainly separators.

Compiled from official statistics.

TABLE 5.—*Exports of foodstuffs and agricultural products from Iceland, 1937–1942*

Item	1937	1938	1939	1940	1941	1942
	Short tons	*Short tons*	*Short tons*	*Short tons*	*Short tons*	*Short tons*
Frozen mutton	2,414	2,734	1,986	1,789	23	10
Other meats	1,693	1,900	1,377	276		
Cheese	152	121	218	41		3
Hides	1,591	2,018	1,044	631	1,706	1,559
Wool	801	671	603	148	545	63
Horses, live	[1] 537	[1] 371	[1] 429			
Fresh fish (frozen)	16,616	18,864	22,786	108,875	128,250	150,797
Salt fish and herring	65,765	85,258	73,381	33,840	33,601	15,042
Other fish and fish products	3,825	3,825	3,838	1,108	605	141
Herring meal	28,051	19,731	20,670	24,402	16,614	16,517
Other fish and liver meals	6,700	5,069	8,654	1,063	4,544	3,153
Cod-liver oil, medicinal	4,137	4,217	6,186	5,750	4,479	5,303
Herring oil	22,651	25,162	19,144	24,730	30,602	29,240
Other marine oils	2,044	2,498	2,674	357	1,500	578

[1] Number.

Compiled from official statistics.

[2] CLARK, AUSTIN H. ICELAND AND GREENLAND. Smithsn. Inst. War Background Studies, No. 15, 103 pp., illus. 1943.

The New Jute-Production Industry of Brazil

by **CECILLE M. PROTZMAN***

The Amazon Valley of Brazil is rapidly gaining in importance as a source of fiber to replace imported jute, used in large quantities to make wrapping material for products of Brazilian farms, forests, and factories. A serious shortage was threatened when India, the source of the world's commercial supply of jute, was almost cut off from the Western Hemisphere by wartime curtailment of shipping. The resulting urgent need for a domestic fiber supply for Brazil has been met partially by the increased harvest of many varieties of wild fibers, which have long been used as jute substitutes in varying amounts; however, the expansion of jute cultivation in Amazonas and Pará has been unquestionably more significant. The history of Brazilian jute production began with experimentation for meeting a peacetime economic need, continued through long years of disappointment and partial success, and now has reached a period of cultivation under wartime conditions that are exceedingly favorable for expansion.

Jute bags, burlaps, and hessians are in great demand in Brazil. The coffee crop alone now requires about 15 million bags annually, and during pre-war years even more were needed. Jute products are used as bagging or wrapping for sugar, grains, cocoa, potatoes, babassú kernels, castor-beans, feed, fertilizers, wool, cotton, and many others of the varied products of Brazilian farms, forests, and factories. The fiber is utilized in the manufacture of twine, rugs, and carpets, and the cloth serves as backing for linoleum and oilcloth.

The production of jute is centered in India, where, under pre-war conditions, considerably more than 95 percent of the total world supply, or approximately all of the commercial supply, was grown, although some production occurs in Burma, Japan, eastern Asia, Egypt, and French West Africa. Introduced from India to the Western Hemisphere, jute cultivation has been attempted not only in Brazil, but also in Argentina, Cuba, Mexico, the United States, and several other countries.

Most Western Hemisphere growers have met with discouragement because of the large labor requirement and the relatively high wage rates. Since approximately 1,000 persons are needed for cultivating and processing each square mile of the crop, a large supply of cheap labor is necessary for successful operation wherever jute is grown, because no satisfactory machine for fiber processing has yet been developed. Outside India, jute probably was first spun and woven at Abingdon, England, but the present world centers are Calcutta and Dundee.

Before the war, Brazil's jute came from abroad, but recently domestic fibers have supplemented imported jute to an increasing extent. Mill consumption of jute during 1942 consisted of almost equal amounts of domestic and imported fibers. Brazil has a plentiful supply of wild fiber plants, and several varieties, with similar characteristics, are known collectively as malvaceous fibers. They have long been gathered in fluctuating quantities according to the incentive of prevailing fiber prices, but jute seems to be more satisfactory for burlap manufacture.

The many attempts made to cultivate jute in Brazil have met with varying degrees of success. Cultivation is now located along the banks of the Amazon River and its tributaries, to some extent along the rivers in Espírito Santo, and on a small area in the State of Rio de Janeiro. The industry has prospered under wartime conditions and brought gratifying results to producers. It has made during the past several years an important contribution to the amount of burlap-type fibers grown in Brazil for consumption by domestic mills.

Experimentation and Early Developments

Brazilian consumers had, until recent years, been dependent on imports from India for practically their entire supply of jute fiber during nearly 80 years. Consumption of large quantities of jute products as early as 1900 led to an interest in establishing a domestic industry to supply the demand. Attempts at cultivation were sponsored from time to time by the Government, coffee growers, fiber-buying firms, and by interested individuals. São Paulo continues to be the principal manufacturing State. At the present time the mills of São Paulo account for more than two-thirds of the total Brazilian consumption of jute-type fibers, and in earlier years the proportion was even greater. (See table 1 for imports of jute

*Office of Foreign Agricultural Relations.

This article is based largely on WERNIMONT, KENNETH, JUTE FIBER PRODUCTION IN BRAZIL, U. S. Cons. Rpt. 901, 25 pp., October 4, 1944 [Hectographed], and UACIMA FIBER PRODUCTION IN THE STATE OF PARÁ, U. S. Cons. Rpt. 1079, 5 pp., November 30, 1944 [Hectographed].

into Brazil and the relative importance of Santos, São Paulo, as a port of entry.)

TABLE 1.—*Imports of jute fiber into Brazil, by ports of entry, 1934–42*

Year	Santos	Rio de Janeiro	Porto Alegre	Recife	Salvador	Belém	Others	Total
	1,000 pounds	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*
1934	33,082	4,680	-------	986	7	937	-------	39,692
1935	29,683	9,863	1,601	1,993	-------	2,012	-------	45,152
1936	34,185	8,208	2,522	1,410	225	1,510	84	48,144
1937	42,344	9,158	3,774	3,708	2,346	970	275	62,575
1938	34,008	9,855	2,773	4,438	2,864	677	1,098	55,713
1939	42,245	6,296	1,585	2,489	2,343	1,541	1,140	57,639
1940	37,992	10,060	143	624	245	159	119	49,342
1941	16,459	2,167	401	-------	161	-------	-------	19,188
1942	29,301	6,014	1,265	-------	-------	-------	90	36,670

Compiled from official statistics.

The earliest attempts at jute cultivation were made near the center of consumption. Two sites along the coast south of Santos were planted early in the twentieth century. Although one was worked by an independent operator and the other was sponsored by the São Paulo Department of Agriculture, apparently neither was particularly successful, since they were under cultivation only 2 or 3 years.

No other plantings appear to have been made for some time, but soon after 1920 seed was imported from India by a private company. Plantings were made near the town of Presidente Prudente in the western part of the State of São Paulo and also at Campinas north of the city of São Paulo in the southeastern part of the State. After failure of the first several crops, the firm brought a specialist from India to take charge of the project. Dry soil was chosen, the seedbed was not prepared with any great degree of thoroughness, and the seed was planted in rows. The plants grew quite satisfactorily, but labor costs for separating and cleaning the fiber were discouragingly high, and neither English nor Brazilian capital could be interested in developing the project in competition with low-priced fiber from India. Also, the coffee industry was a serious competitor for the available labor supply, and there was difficulty in obtaining the necessary number of laborers for the harvest season. The fields were cultivated for about 7 years, but they were finally abandoned.

About 1929 or 1930 a colony of Japanese near Parintins in Amazonas became interested in the growing of jute and embarked on a long series of experiments requiring patient persistence. Botanists of the colony believed the Amazon Valley to be similar to the Ganges of India in soil, climate, rainfall, and seasonal floods, and therefore suitable for jute. Their agricultural school was responsible for obtaining a supply of seed from São Paulo and the importation from Japan of seed originating in India. Planting was on alluvial flood lands on the banks of the Amazon River near the school.

Results, after 2 years of cultivation, were unsatisfactory as to both yield and length of fiber. In the following year seed was received directly from the Japanese consul in Calcutta. Yields were again disappointingly low. The stalks were small and averaged less than 5 feet in height, but fiber sent to Japan for testing purposes seemed to possess much the same tensile strength and other qualities as imported jute. The report from Japan, together with the encouraging growth of the 1932 crop, resulted in the sending of a specialist from Tokyo to India to study the successful cultivation methods used there and to obtain seed for further experimentation. He was also instrumental in bringing other immigrants from his homeland, thus increasing the meager labor supply.

About 150 Japanese students and agricultural colonists took part in the 1933 plantings, working under instructions in accordance with the new information that had been acquired. Seed was obtained from India a third time, and crops were planted this time at the beginning of the rainy season in the latter part of the year. Nevertheless, the harvest was again disappointing. There was one item of interest, however, and that was the discovery by one of the planters of two unusually large, erect stalks that attained superior height. Although special attention was given to these plants, one was destroyed by high water. The other grew to a height of more than 13 feet. Seed saved from the remaining plant was analyzed as *Corchorus capsularis* and was destined to lead eventually to many strains of Amazonian jute that are now cultivated successfully in the valley. Some of these varieties are the Oyama, Parintins, Santarém, Amazon, and Brazilian.

Crops from the new seed—Oyama—required an average of about 120 days to mature, compared with 60 to 70 days required for other plantings, but the average yield of fiber per acre was higher because of stronger, taller stalks, and the quality was later improved through experimentation. By 1936 the supply of the new strain of seed was sufficient for planting 37.5 acres. One planter had 25 acres on Maximo Island, and another had 12.5 acres on overflow land near the school. About 10 tons of fiber produced by the two men and marketed in Belém the following spring were the first sales of Amazonian jute.

The years 1936 and 1937 marked a turning point in the development of the industry. A new experiment at Breves near the mouth of the Amazon was successful in 1938 but was abandoned the following year

in favor of more extended activity under municipal encouragement at Santarém, which later ranked second to Parintins as a jute-growing center, first under the Japanese, and later under Brazilian direction.

The Japanese organization, which established and expanded production, enjoyed special governmental concessions, granted for a period of 20 years, with respect to land selection and tax reductions. When Brazil entered the war, however, authorities of the Government took over the company, along with lands of individual Japanese farmers. Local capital is currently invested in the industry, although many Japanese have remained to work alongside native Brazilians. There is now in the Amazon Valley a total of about 5,000 families, comprising approximately 30,000 persons who are engaged in jute growing either as independent farmers or as hired laborers.

Farmers in southern Brazil, encouraged by higher prices after the outbreak of war, began cultivation about 1941 on two experimental farms. They used Amazonian seed. A low area around the city of Rio de Janeiro, known as the Baixada Fluminense, was chosen as a suitable site, but labor difficulties hampered successful operation. The other project, in the State of Espírito Santo farther north, was more successful, and early estimates indicated that the 1944 crop would exceed 800,000 pounds.

Method of Cultivation

Jute cultivation is carried on almost entirely with hand labor. Methods are the same as those followed by Bengal natives of a century ago, when jute had not yet gained importance in the commercial world. Only after the fiber has been processed and dried does present-day machinery replace the ancient hand labor; modern spinning and weaving mills present a happy contrast to the old hand looms.

(Courtesy of Octaviano Gomes de Paiva)

FIGURE 1.—Bundles of jute in shocks in Espírito Santo.

(Courtesy of Julio Poetzscher)

FIGURE 2.—Woman separating jute fiber from woody portion of the stalks.

A prominent exception to the usual type of jute plantation in Brazil is one of about 500 acres in Espírito Santo. It is on land high enough from the water to allow tractor plowing and the use of disk-harrows for working the land. Planting is done with a mechanical seeder similar to those used for alfalfa. When mature, the crop is cut by power harvesters, and the bundles of stalks are hauled to retting tanks built near the water supply.

Hand labor is necessary for all remaining steps in the preparation of the crop for market on this as on all other farms. The fiber, which is in the stem close under the outer bark, is separated from other parts of the retted stalk, washed, hung to dry, and sorted for baling in much the same manner wherever jute is grown. No satisfactory machinery for these processes is now available.

Methods in northern Brazil differ considerably in planting and harvesting operations. Few machines are used, even on the higher areas. On the low lands machinery cannot be used, because the fields often

consist of many small, narrow patches of land, resembling natural levees, surrounded by water and strewn with stumps and logs—some left when the land was cleared and others washed up by the annual high water. The only means of communication between patches is by boat or native canoe. Transportation from the cities is long and difficult. There would be trouble not only in using machinery on the farms but also in getting it to them.

All work is determined by the rainy season. New land is cleared for the first crop in time for the jungle growth to be cut, piled, and burned during the driest season, about October or November. Any other season would be too wet for the brush to burn. Little soil preparation is necessary. The seed is usually mixed with an equal portion of dry sand and planted broadcast at the very beginning of the rainy season, in late November or December. Delay in planting results in insufficient growing time before the floods come, since about 120 days are necessary for growth, and flood waters rise appreciably in 3 or 4 months after the first rains. Harvesting may begin in late March, and most of it is finished before the end of June.

The plants grow rapidly and soon choke out other growth, making little care essential during the growing season. Small yellow blossoms begin to appear when the plants are 3 or 4 months old. For fiber of best quality, cutting should take place at the end of the blossom stage but before the seeds begin to form. The stalks are usually cut several inches above the ground. They are then prepared for retting by being tied into small bundles of 15 to 30 stalks each, measuring about 18 inches in circumference.

Much labor is needed during the short cutting season. There is little time, because the plants rapidly become overmature, and also at this time flood waters soon rise high enough to damage any crops that are still standing. Sometimes farmers begin harvesting their crop soon after the flower buds appear and continue cutting as long as the rising water permits, but the consequent lack of uniformity in fiber quality causes grading problems and often results in a disappointing price. After the close of the rainy season, the water continues to rise for some time. The first bundles are retted and washed in the lower part of the field, but successive bunches are placed on higher ground as the water becomes deeper until often the last ones are at the door of the family hut.

Retting is accomplished by leaving the bundles of stalks under water until decomposition has softened the stems and loosened the waxy material between the fibers. Retting for too short a time results in difficulty in cleaning and often mechanical damage to the fiber in the process. Overretting weakens the fiber. The time required varies from 15 to 20 days, according to the maturity of the stalks and temperature of the water. Ideas differ as to the kind of water that gives most satisfactory results, whether still or running and whether clear or muddy.

The fiber is finally separated from the bark and the inner woody portion of the softened stalk by scraping or stripping by hand and then beating the long bunches against the water until all pieces of bark or clinging foreign matter are removed. The worker often stands waist-high in water for this hard and disagreeable part of the work. When the fiber is clean, it is then ready for drying.

The strands are spread over drying racks built on higher ground and are tended carefully to prevent weakening and discoloration caused by rain or sun. Drying must be thorough, and the whole lot must be carried to the shed whenever rains occur. If the fiber has not been completely dried before it is tied into bundles for market, heating takes place, and both color and strength deteriorate. Combing is done by hand in the work sheds; then the fiber is sorted and tied into loose bales for the trip to market.

By the time the first crop is ready for market, the water has usually receded enough to allow preparation for a second planting, made in July or early August and harvested in October or November. The autumn crop frequently is harvested for the seed, which mature about 4 weeks after the flowers open. The behavior of the river in the different localities makes some variation in the times of planting and cutting the crop.

Production Areas

The soil and climate of the Amazon Valley are favorable for jute. Present production is mostly on the low flood lands, but upland areas are utilized in southern Brazil and in some regions of Amazonas and Pará. Practically none of the plantations have large fields devoted entirely to jute. They consist of many small patches separated from each other by water and jungle. These patches are located on the alluvial overflow banks of the river at intervals along almost the entire length of the Amazon River and the lower reaches of many of its tributaries, making a chain of jute farms extending from the western boundary of Brazil to the Atlantic Ocean. The principal centers are Santarém, Jurití Novo, Obidos, Parintins, and Manaus (fig. 3).

Muddy water, especially that of the Madeira

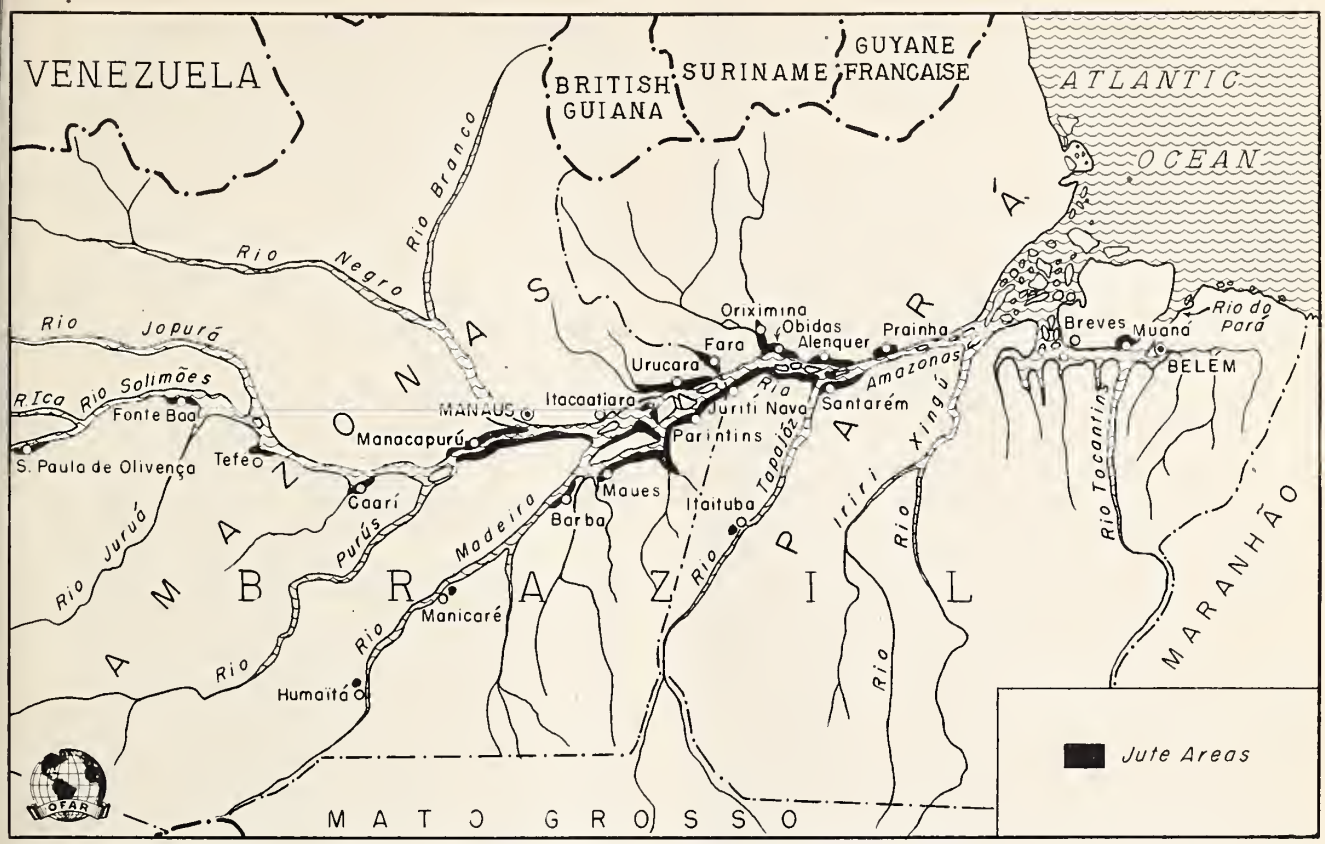

FIGURE 3.—Areas of jute cultivation in the Amazon Valley.

River, seems to be favorable for growing and retting, but the black water of the Rio Negro contains too little sedimentation. Fertility of the low river land is constantly renewed to some extent with silt from the seasonal overflow. Such land is suitable for jute if it is free of water for 5 or 6 months of each year and is never under standing water. The same plot can be used for 2 or 3 successive years; then new land must be cleared and the old allowed to go back to the jungle. A satisfactory system of rotation has not been worked out. Corn seems to be followed by greatly reduced production, truck crops are too perishable to be transported to far-away markets, and rice is apt to be eaten by the great numbers of birds.

Available land for expansion of the industry is difficult to estimate. Much low-lying land in Rio de Janeiro appears to be suitable for jute cultivation, and an experienced grower in Espírito Santo believes that as much as 100,000 acres may be available in that State along the banks of the eight principal rivers. Upland areas in the Amazon region, although used to some extent, seem less suited to the crop than the lowlands, because the soil is poorer, it washes away rapidly after being cleared, and water for retting is too far away. Undoubtedly there are numerous patches of suitable land along the Amazon and its tributaries, but they are small and widely separated.

The acreage under jute cultivation in the Amazon Valley, estimated at the present time at 16,000 acres, seems small when compared with the total in India of between 2 and 3 million acres, but the 13-million-pound Brazilian crop of 1943 was equal to about one-fifth of the total consumption of all fibers by domestic jute mills during 1942. Early estimates of the 1944 crop of Brazil are equal to about 50 percent of pre-war consumption of jute in São Paulo, the largest consuming State. Shipments from the Amazon Valley to other Brazilian points (table 2) indicate

TABLE 2.—*Shipments of jute fiber from the Amazon Valley of Brazil, 1939–43*

Year	Origin of shipments		
	Belém	Manaus	Total
	1,000 pounds	*1,000 pounds*	*1,000 pounds*
1939	42	371	413
1940	224	716	940
1941	1,757	2,068	3,825
1942	1,419	6,107	7,526
1943	5,907	7,108	13,015

Compiled from official statistics.

but do not accurately reflect the amount of fiber produced in the region.

Characteristics of Plant and Fiber

Jute is an annual plant with slender, cylindrical stems from 6 to 12 feet tall and usually only a little more than 0.5 inch in diameter. The branches are found only near the tops, thus leaving a high percentage of long fibers in the stalks. The leaves are from 2 to 4 inches long, with serrated edges ending in a sharp point. They are distinguished by small tail-like appendages at the base. The small yellow flowers appear in groups of two or three together.

There are two species of jute plants, known as *Corchorus capsularis* and *Corchorus olitorius*. They are so much alike that they are difficult to distinguish from each other, except by the pods and seeds. The *Corchorus capsularis*, or round-pod jute, has a rough, almost round seed pod, which is about equal in diameter to the plant stalk. It contains small brown seeds. The other species has bluish seeds contained in a smooth, cylindrical capsule about 2 inches long.

The round-pod jute, which is more common, is the species that grows successfully in Brazil. It thrives in river valleys, where the land is subject to periodic overflow; the long-pod species grows on higher ground and is destroyed by flooding. Both species require a fertile silt, or sandy loam, soil and a warm, wet climate, with an annual rainfall of more than 40 inches. A mean daily temperature of 70° to 90° F., such as that of the Bengal jute area or the Amazon Valley, favors their growth.

Jute, as well as flax, hemp, and ramie, is a member of the bast-fiber group. The soft lustrous strands of jute fiber are from 5 to 10 feet long, and their color ranges from a creamy white to brownish gray, which becomes darker with age. A part of the fiber—about 6 to 12 inches at the base end—is hard and coarse and cannot be well cleaned. These ends are cut off, sold on the market as butts or cuttings, and used principally for the manufacture of cotton bagging.

Jute has less durability and strength than flax, hemp, or cotton. It is made up of ultimate cells that are short, smooth, thick-walled, and blunt at the ends. The mean ratio of diameter to length of these cells is only about 125, which is comparatively low for qualities of strength. Chemically, jute is composed of a relatively low percentage of pure cellulose as compared with other common vegetable fibers. Jute fiber can be readily dyed but is considerably weakened by bleaching. It has little elasticity. It is especially suitable for use where cheapness is important.

Quality and Classifications

The quality of Brazilian jute is relatively good. Fiber that has been harvested and processed by careful workers using approved methods is readily interchangeable with imported Indian jute. During these early years of the industry an undue amount of the lower grades has appeared in the market, because inexperienced workers do not realize the importance of maintaining uniformly high standards of quality and they need time to acquire knowledge and skill in handling the crop.

When processing the earlier crops, jute was sorted at the plantations into four grades, A, B, C, and D, and marked with cloth tags of various colors. The Brazilian Government has since cooperated with the industry in establishing, by a decree of February 1941, a legal grading system for export sales of both jute and the malvaceous fibers similar to jute. The classification gives descriptions for types 1, 3, 5, 7, 9, and "substandard." In general practice, samples of the various grades are used in making sales.

Official supervision of baling and classification has been in operation in Pará for several years and was begun in Amazonas during 1944. Buyers are beginning to make price distinctions of as much as 3 percent for jute classified either as better than, or below, type 5. About half of the jute and more than 40 percent of the malvaceous fiber classified in Pará fall in type 5. The native malvaceous fibers are mixed with jute during periods of fiber scarcity and may be competitive to some extent with Brazilian jute in times of plenty.

Yield

Yields of jute fiber vary considerably. Each crop probably averages approximately 1,000 pounds to the acre, or about the same as the average in India, but Brazilian output is increased when two crops are grown in one year. Land in India produces only one crop of jute each year. Reports from experimental plots have varied from 900 to as high as 2,000 pounds per acre.

Flooding causes considerable loss in Brazil each year. A study of the problem revealed that some of the damaged crops were grown on land susceptible to early flooding, some were planted at an unfavorable season, and some were lost because the farmer had planted more than his available labor supply could harvest. More information concerning the river changes and experimentation in both the time of planting and the selection of plots for cultivation have given encouraging results.

Jute in the Amazon Valley is subjected to some pests, but none to a serious extent at the present time. The planted seeds and young plants are sometimes eaten or carried away by ants and chameleons or lizards, and the larvae of a local moth have cut stalks at the base in some fields, but few diseases have attacked the plants.

Seed Selection

The method of seed selection is receiving more attention as the improved results of controlled selection are becoming more widely realized. Inexperienced farmers in the Amazon Valley were at first inclined to cut the better part of their crop for fiber and leave the shorter stalks for seed. The practice resulted in disappointing quality and sometimes complete loss the following year.

The success of the crop is greatly affected by the maturity of the seed when harvested. Complete maturity causes waste, because much seed is lost from the pod before it can be gathered. Lack of maturity results in defective germination.

Early in the development of jute cultivation, the Government of Amazonas ordered that each farmer harvest a definite proportion of his annual crop for seed. A São Paulo firm of buyers has carried on extensive experiments in seed selection and, with the help of a Government agent, has distributed its own seed without cost to as many growers as the quantity would supply. Domestically grown seed was gathered in the past year by specially trained workers and is now available in considerable quantities for the first time. Seed was furnished for the 1944 season by the Federal-State Agricultural Development Sections in Amazonas and Pará and by private cultivators in Espírito Santo with the cooperation of the Government.

Living Conditions on Jute Plantations

Living conditions for the jute workers leave much to be desired. The nature of the crop and the necessary means of processing it make much of the work difficult and unpleasant. Insects, snakes, and diseases of the jungle are a constant menace to the health and even the lives of the worker and his family. The large commercial plantation has been a necessary part in the development of the industry, but the importance of the individual planter is increasing.

Business men or firms, usually from cities of the region, often buy or lease large tracts of land for cultivation. They supply the land, capital, and general management but hire laborers to do all the manual work. Comparatively good wages prevail, although they are seasonal and vary with the type of work.

A typical Amazonian plantation is on rented land several hours from town by canoe, the only means of transportation. Three to five families live together through the busy season, from October to July, in one hut about 16 feet square. The hut is like the nearby work building, except that it has walls of palm leaves instead of being open. Both structures are built with a pole framework and thatched roof. The floor is 3 feet or more above the ground. The two buildings and the drying racks are grouped on the highest available ground in order to be as much above water as possible. In the family hut, hammocks for sleeping are stretched between the poles at night and rolled up by day to leave space for eating and other activities. Boxes serve as table and chairs and are the only furniture.

The principal foods of the workers are coffee, sugar, beans, rice, manioc meal, and dried fish. They are stored in a corner of the hut which is partitioned off for the purpose. A crude charcoal stove for cooking is kept in a porchlike space. There is no protection for the food either in kitchen or storage corner against weevils, insects, or mold.

Conditions are least desirable during the rainy season. The first showers are light, but soon tropical downpours, interspersed with intense sunshine, are a daily occurrence. The crop grows tall around the little living center and thus often increases the unpleasantness from the intense heat. After the rains cease, the water continues to rise around the buildings until finally it is high enough for canoes to be brought to the door. The men stand immediately outside the hut to clean and wash the fiber; the women must wade about to tend it on the drying racks.

The independent farmer usually fares a little better than hired laborers. His dwelling often is inadequate but is occupied by only his own family. He chooses a promising plot of jungle land, clears away the brush and trees, builds his home, and plants his crop. The field is usually about 2 to 5 acres in size, since a family can harvest the crop from that much land without having to hire help. The cash outlay for the crop is small. Whenever he can build his hut on land high enough from the river, the farmer often raises a few chickens, a pig, and perhaps even manioc, rice, sugarcane, and several pineapples.

The small farmers usually live permanently in the region and are more stable than hired seasonal labor-

ers. São Paulo buying firms with branch organizations in Amazon towns have given encouragement to independent planters. They offered to finance operations with loans up to about $12.50 per acre for planting and for harvesting at the rate of 1.5 cents per pound of fiber obtained. The plan was carried out on a small scale during the 1943–44 season, and it was so successful that continuation on a larger scale was arranged for succeeding crops.

Wages and Costs

The larger commercial plantations are usually on purchased or leased land, and the manager depends entirely upon hired laborers for all kinds of work. Meager living quarters are furnished for the families, and laborers are paid according to the type of work they do. Men do the clearing, planting, and harvesting, and women and children often help with the lighter tasks, such as drying, combing, sorting, and tying the fiber.

Wage rates are relatively good, considering living costs and the few opportunities in the region for getting to stores or other places where money is needed, but the work is seasonal. A rate of 40 to 45 cents a day is paid to the men for clearing the land and other ordinary work about the plantation and about 25 cents to women and children. Men who cut the crop are paid by the bundle. A man can cut, tie, and place in water for retting about 100 bundles per day, thus earning about three times as much as the ordinary worker. A laborer who can turn out a daily average of 250 to 300 pounds of wet, washed fiber can earn from $1 to $1.15 per day at the prevailing pound rate.

FIGURE 4.—Bales of jute in a warehouse at Manaus.

In terms of cost to the producer, clearing of the land will vary from $4 to $7 per acre. Land is cultivated for 3 years, making the average cost of clearing about $2 per year. The work of cultivating, planting, and generally caring for the plantation costs about $6 or $8 in the Amazon region and from $2.50 to $3.50 in Espírito Santo, where much of this part of the work is done by machinery.

Estimates of the cost of harvesting crops in the Amazon Valley range from $17 to $19 per acre, compared with $22 to $24 farther south. Retting is more costly in Espírito Santo, where wage rates are a little higher, and where tanks must be built and extra handling is necessary. In the Amazon Valley the stalks are retted almost on the spot where they grew.

The original cost of the land is small—often nothing at all along the river banks, where individual producers move in without either purchase or taxation and begin cultivation on any suitable land they can find. Sometimes operators on rented land must pay as much as $1.25 per acre yearly, but rents are usually relatively low in jute-producing regions.

Seed purchased in the market has cost, since 1938, about 70 cents per pound. Rates for credit facilities are high, between 10 and 30 percent, and may average as much as $3 for each acre of crop harvested.

Production costs to the commercial grower, therefore, total nearly $32 for each acre of his crop, or somewhat more than 3 cents per pound of prepared fiber. The independent farmer has less actual expense in the production of his crop and can operate more economically.

Marketing and Price

The price paid to the producer is usually less than half the final cost of fiber to the mills. The marketing cost has been variously estimated at an average of 4 or 5 cents per pound for jute originating in the Amazon Valley. Transportation by small boats or canoes is necessary from the plantations to collection centers at Manacapurú, Manaus, Itacoatiara, Parintins, Obidos, and Santarém. The distance is sometimes as great as 500 miles. Shipping rates are high, because the loose bales are bulky and are not even accepted by some of the regular boats. Since through freight is rarely obtainable from Manaus to Brazilian ports beyond Belém, river freight and ocean freight must be paid separately, with extra handling charges in Belém.

The total marketing cost of about 4 cents a pound from Santarém usually consists of an average of 28

percent for taxes and fees, 37 percent for freight and insurance, and 35 percent for loading and unloading, drayage, baling, shrinkage, and other miscellaneous items. The cost from collection centers farther up the river increases with the greater distance and with the higher tax rates in Amazonas. Since freight charges are based on volume rather than weight, the cost per pound varies.

A wartime price of 5.75 to 7.25 cents a pound was paid for jute at Amazonian collection centers during the past year. This price does not include marketing costs from the centers to consuming mills. In Espírito Santo the current price ranges as high as 12.5 cents. Larger profits can be realized by growers in southern Brazil, where the comparative nearness to consuming mills makes transportation costs much less than from northern Brazil.

During the last 5 years before the outbreak of the present war, medium-grade jute from India sold at an average of only 4 to 4.5 cents per pound in the New York wholesale market, and the average price of imported jute in Brazil from 1935 through 1939 was between 5 and 6 cents, c. i. f., Brazilian port. It is interesting to note that only 3 cents was paid at Parintins in 1936 for the first lot of domestic jute that was marketed there. The amount was less than was then being paid for native malvaceous fibers in Belém, although the price of imported jute has always been well above that of domestic fibers.

TABLE 3.—*Consumption of domestic and imported fibers in Brazil, by States, 1941–42*

State	1941		1942	
	Domestic	Imported	Domestic	Imported
	1,000 pounds	*1,000 pounds*	*1,000 pounds*	*1,000 pounds*
São Paulo	7,303	22,104	13,959	26,167
Pernambuco	9,216	254	9,880	70
Federal District	3,573	3,128	3,764	3,484
Rio Grande do Sul	1,036	1,284	1,414	1,899
Baía	1,229	1,264	700	1,702
Pará	1,716	217	2,043	62
Maranhão	379	436	896	147
Espírito Santo	417	353	806	445
Paraíba			105	
Total	[1] 24,869	29,040	[2] 33,567	33,976

[1] Jute accounted for about 271,000 pounds, or only 1 percent.
[2] Jute consumption jumped to 3,656,000 pounds in 1942, and represented 11 percent.

Compiled from consular report.

Imports and Consumption

Imports of jute fiber increased from about 27 million pounds during 1915, when the trade was somewhat depressed because of war conditions, to a peak in 1937 of nearly 63 million. Imports of jute manufactures increased less than a million pounds during the same years, amounting to 16,500,000 pounds at the end of the period. Three years later, when activity of domestic mills began to affect trade figures, only 28,000 pounds of jute products were imported.

São Paulo is the principal manufacturing State, and 68 percent of the jute imported into Brazil during 1935–39 was entered through the port of Santos in that State. A large part of the domestically produced fibers also are utilized by São Paulo mills, and present Government regulations encourage the use of even greater amounts. (See table 3.)

When war conditions made shipping difficult and threatened to wipe out supplies of imported fiber, Brazilian mills began to mix domestic varieties in increasing quantities with jute from abroad. Owing to the unusually small quantity imported in 1941, the Government required all burlap yarns to be manufactured from a mixture of foreign and domestically produced fibers in the proportion of 10 percent domestic fibers to 90 percent Indian jute. The proportion was later increased to 25 percent Brazilian fibers and has been adjusted several times since, as conditions of supply varied. As much as 70 percent was required during a part of 1942. Many Brazilian fibers were not quite so satisfactory as imported jute when used in such large proportion, and only 60 percent was required during most of the past year. Yarn for burlap and bags to be used within Brazil may be produced with a lower proportion of domestic fibers.

The demand for malvaceous fibers caused production in 1942 to be nearly treble the 1941 crop. Consumption rose to first place among domestic fibers. The 5,500,000 pounds produced in only the three States of Espírito Santo, Minas Gerais, and Rio de Janeiro was greater than the total Brazilian consumption of domestic jute during the year. With rapidly increasing jute production, however, mal-

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vaceous fibers probably will not hold their present important position because of lower quality.

During 1942, consumption of jute and other fibers suitable for burlap was slightly more than the average consumption of 67,400,000 pounds during the 3-year period 1937–39. Nearly equal quantities of Brazilian fibers and imported jute were used in the total production of nearly 9 million pounds of yarns, 15 million yards of burlap, and 44 million bags. By the middle of 1944, the rate of production had increased to approximately 100 million bags and 11 million pounds of burlap per year. Brazilian consumption before the war required almost the entire output of jute products, both fiber and manufactured goods; but small amounts of mill products have been exported during the past several years to Argentina, Uruguay, Chile, and Ecuador. Less than 235,000 pounds of bags and about 625,000 pounds of other manufactured jute products were shipped to other countries during 1940, but exports have increased during succeeding years. At present all surplus burlap is under contract for shipment to the United States.

Present Status and Post-War Prospects

Jute is considered the most satisfactory fiber for making bags and burlap. It sells in the world market at a comparatively low price, yet it is sufficiently strong, pliable, and durable for the purpose. A strong demand in the Western Hemisphere served to create an interest in Brazilian production, and during the war this interest has developed into a definite need because of curtailed supplies from abroad.

Jute cultivation has become established in Brazil, because the climate and soil there are favorable and the quality of fiber produced is good. Expansion has been rapid, and large areas of suitable jungle-covered land are available for clearing. Deterring factors to further expansion of cultivation lie in the small labor supply in the region; the difficulty of clearing away the jungle; the separation by swamps and rivers of suitable land into small patches, or islands, without ready access to each other or to population centers; and the difficult and expensive transportation to distant markets.

Wartime prices of jute in the Amazon Valley are about double the cost of production. Attractive returns for the growers and relatively high wages for the laborers have drawn Brazilians to the jute region, even though living accommodations are usually inadequate, working conditions are often disagreeable, and life is always beset by tropical hardships. Any measures taken to diminish the hazards to workers and their families and any improvement that can be effected in living conditions would undoubtedly encourage increased cultivation, even if wages are lowered after the war. Living and working conditions are not apt to be made attractive enough in the near future, however, to outweigh much decrease in worker incomes.

The Brazilian Government has encouraged production and is continuing its study of pertinent problems. Improvements are needed and probably will be made both in the development of varieties grown and in the general adoption of standard classification methods.

The small independent farmer, with ability to produce a good grade of fiber, appears at present to be in a little better position to meet cost competition in the post-war market than the commercial producer. His cash outlay per pound of fiber is smaller, and, consequently, he can accept a greater reduction in unit price for his crop without suffering financial loss. He will, in general, be surer of saving his crop, because he is not dependent for its harvest upon hired laborers. The commercial producer not only needs great numbers of workers during the short cutting season, but he must also compete for them with agricultural producers who can offer either steady jobs or more agreeable work.

The transportation cost will be a problem commonly affecting all producers and consumers, not only because it represents so large a proportion of the final price of Brazilian fiber, but also because it tends to hold the price of domestic jute above that of imported fiber.

The Government decree requiring the admixture of large amounts of domestic fibers with Indian jute serves not only to extend the supply of imported fibers, but it also encourages home cultivation by assuring a market for Brazilian fibers, with jute in a preferred place. The malvaceous fibers, which sell at lower prices and are presently used in large quantities as substitutes for jute, are not likely to offer serious competition.

Extensive production of jute fiber after the war will depend considerably on how well the problems of quality, grading, transportation, labor supply, wages, and prices can be met. There seems to be no doubt that under prevailing conditions cultivation will continue to expand. Brazilians in the industry hope that manufacturers may be able in a short time to furnish bags and burlap for all local needs, and possibly for those of neighboring countries, from the supply of domestic jute fiber.

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